Phys 113 – November 20, 2012

  8 am Hubbell Aud. t.
- Much material – will send out email shortly w/ details of material coverage

Happy Thanksgiving!
Fluids

Statics

Yes, they can be fun if you've not already discovered that.

Specific gravity = \( \frac{\rho_{\text{material}}}{\rho_{\text{H}_2\text{O} \text{ at } 4^\circ\text{C}}} \)

Pressure = \( \frac{\text{Force}}{\text{Area}} \) \( \text{N/m}^2, \text{Pascal, torr, Atm} \) in MKS
Pascal’s Law

\[ P - P_{\text{top}} = \Delta P = gh \]

\[ P = P_0 + gh \]

Pressure applied to an enclosed fluid is transmitted undiminished to every point in the fluid and the container walls.

It’s the height, not the weight!
Archimedes
Syracuse, Sicily (Greek at the time)
287 - 212 BC

When a body is partially or completely submerged in a fluid, the fluid exerts an upward force (Bouyancy) on the body that is equal to the weight of the displaced fluid.
What fraction of the iceberg is submerged?

\[ F_{\text{bouyant}} = F_b \]

\[ M_g \]

\[ F_b = \text{wt of displaced fluid} \]

let \( V \) = volume of iceberg

fraction submerged = \( x \)
\[ M_g = S_{\text{ice}} V_g = F_b = (S_{\text{seawater}} \times \frac{V}{\gamma}) g \]

Divide both sides by \( S_{H_2O} \) at 40°C.

\[ (S_{\text{g. ice}}) V_g = (S_{\text{g. seawater}}) \times V_g \]

\[ \frac{S_{\text{g. ice}}}{S_{\text{g. seawater}}} = x = \frac{0.92}{1.03} \approx 0.89 \]
End of material for exam 3
Fluid dynamics - Hydrodynamics

ideal Fluid

No viscosity

incompressible

Equation of Continuity

\[ A_1 V_1 \Delta t = A_2 V_2 \Delta t \]

Volume fluid flowing in at the left

\[ A_1 V_1 = A_2 V_2 \]
Energy conservation

For some element of fluid:

\[ W + \frac{1}{2} MV^2 + Mg\Delta h \approx \text{Constant} \]

\[ \frac{F \cdot d}{V} + \frac{1}{2} \frac{MV^2}{V} + \frac{Mgh}{V} \]

\[ V = A \cdot d \]
Bernoulli’s Equation

\[ P + \frac{1}{2} \rho V^2 + \rho gh = \text{CONSTANT} \]
\[
\left( p_T + \frac{1}{2} s v_T^2 + g_{\eta} h \right)_{\text{Top}} = \left( p_B + \frac{1}{2} s v_B^2 + g_{\eta} h \right)_{\text{Bot}}
\]

\[
p_T + \frac{1}{2} s v_T^2 = p_B + \frac{1}{2} s v_B^2
\]

\[
v_T < v_B \implies p_T > p_B
\]